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server it would seem that our modern forest leaves are absolutely identical with the cretaceous leaves, which, according to Dana's time ratios, flourished about five million years ago. The opponents of the modern theory of origin of species by descent have derived a strong argument from the apparent identity of the modern with the ancient forms. But the identity is apparent only; not real. Lesquereux has noted the fact that the Dakota leaves, as a rule, have entire borders, while the modern forms of the same genera have denticulated or serrated borders. Another difference between the modern and the Dakota leaves consists in the greater thickness and toughness, or, in botanical language, the coriaceous character of the ancient forms. But in the stipules of the Dakota leaves, we not only have a prevailing unilateral position of these organs, as distinguished from their modern bilateral arrangement, but we are able to witness the gradual change from the single undivided form through the successive steps of transformation to the completely separated and finally bilateral pair; each stage of differentiation being indelibly stereotyped upon the sandstone matrix by which the leaves are enveloped.

The accompanying plate will show the chief stages in the development of these organs.

EXPLANATION OF PLATE.

FIGURE 1. Betulites Vestii, Lesqx., var. Obtusa, Lesqx., showing unilateral stipule.

FIG. 2. Betulites Vestii, Lesqx., var. Inæquilateralis, Lesqx., showing another form of unilateral stipule.

FIG. 3. Viburnum Dakotense, Lesqx., var. Longifolia, Lesqx., showing unilateral stipule.

FIG. 4. Viburnum Dakotense, Lesqx., var. Ovatifolia, Lesqx., showing a narrower unilateral stipule.

FIG. 5. A detached unilateral stipule and part of petiole, showing the groove in the stipule.

FIG. 6. Betulites Vestii, Lesqx., var. Latifolia, Lesqx., showing bifurcated unilateral stipule.

FIG. 7. Detached bifurcated unilateral stipule, showing the base of the petiole.

FIG. 7*a*. Opposite side of 7, the stipule itself showing the groove on which the line of division takes place.

FIG. 8. Betulites Vestii, Lesqx., var. Subintegrifolia, Lesqx., showing bilateral stipules, or the bifurcated unilateral stipule completely divided and arranged on both sides of the petiole.

LECTURE.—THE GEOLOGY OF KANSAS.

[The second night of the session was occupied by a lecture on "The Geology of Kansas," by Prof. R. Hay, Junction City. This was given in the auditorium of the High School. It was illustrated by geological sections, a map, and many specimens. The following is a brief abstract of the address:]

"Something has been known of the geology of Kansas from the date of the earliest settlement. In the years 1855–8 there was a controversy as to who had the honor of first saying that certain formations were of Permian age. The Carboniferous age of rocks in eastern Kansas had already been recognized."

The lecturer then gave some account of his own work, and the methods of geological investigation, and the relation of the geology to the topography of the State; and then came a succinct account of the succession of formations, from the lowest (in Kansas), the Sub-Carboniferous of the southeast, to the tertiary of the west, and the quaternary deposits of large areas in all parts of the State. The use of the term Permo-Carboniferous was explained and vindicated; and the *erosive unconformity* of the lowest Cretaceous (Dacotah) on the Permo-Carboniferous in middle-northern Kansas was clearly described; and then followed an account of the position of the Triassic rocks and salt-beds of the southern part of the State. This is a new thing in the geology of the State, and of it the lecturer said, after an illustration of the above-named erosive unconformity:

"This, on comparison with other parts of our country and Europe, shows an omission of the Triassic and Jurassic groups, so that northern Kansas was probably dry land during the time elsewhere used for the deposit of those series of formations. Probably in that time the great valleys of eastern Kansas began to be eroded."

"In southern Kansas there is seen no such contact between the Cretaceous and the Permian. In going west from Winfield and Wellington, after the last of the Permian rocks have been seen, crossing the sandy depression that constitutes the valley of the Chikaskia we see rocks of a new kind. Not Cretaceous, not Permian—but red Arenaceous limestones, red, hard shales, red clays, with thin layers of a lighter color—greenish, grayish, or white. These spread out into the cañoned formations of the Gypsum Hills, where these red rocks have a cap of white gypsum for many miles. These, like the Permo-Carboniferous rocks, have a slight westerly dip, and in Barber and Comanche counties an exposed thickness of about 500 feet. Their depth below the surface and upward increment westward make them have not less than ten or eleven hundred feet of total thickness, lessened in many places by great erosion.

"These—red-beds—are well developed in Kingman county, but disappear to the north under the deposits of the Arkansas valley—fifty to 60 feet at north Hutchinson, 140 feet at Sterling—and the high prairie beyond, to reappear, so far as observed, in only two or three limited localities in the north of McPherson county, near the southern bow of the Smoky river. Besides the borings at Hutchinson and Sterling, those at Nickerson and Lyons show the red-beds to be below the surface. At Lyons and Ellsworth, the Dacotah formations are above them; and in Harper, Barber and Kingman counties, limited areas show the same thing in depressions. But in these places, it is only the upper part of the Dacotah. The salt wells at Ellsworth show the red-beds thinner than at Hutchinson, and those at the latter place are thinner than at Kingman, and at Kingman thinner than at Anthony. The red-beds thin out northerly. The Dacotah thins out southerly. These red-beds we call Triassic, but possibly the upper part may be Jurassic. As yet they have yielded no determined fossils in Kansas."

"At the bottom of the red-beds, and as we think, continuous upward into them and continuous downward into the Permian, are three or four hundred feet of saliferous shales, and intercalated with them the beds of rock salt which have recently become so noted. The salt-beds vary from five to one-hundred feet in thickness, and the shales themselves are strongly impregnated. The water poured down the Hutchinson wells and pumped, immediately comes up a saturated solution: a salt brine so pure that it needs no manipulation, but goes straight from the tank to the evaporating-pan."

With regard to the increase of our knowledge of the Tertiary formations, the lecturer said:

"Eleven years ago, Prof. Kedzie wrote: 'The separation between the Cretaceous and Tertiary formations, though clearly defined, is hardly a sharply-traced line, but rather a stretch of country thirty miles wide, extending across the country from Nebraska to Colorado. Within this band may be found the formations of both periods: the Cretaceous in the low valleys, and the Tertiary upon the high hills.' While this passage represented accurately the knowledge of these formations in Kansas at that time, yet, taken with its accompanying map, it shows to us now the deficiencies of that knowledge. The 'band,' which is to some extent properly described, is much more than one hundred miles wide instead of thirty, and instead of running off to Colorado north of the Smoky river, it crosses the Indian Territory, the Cretaceous outcrop to Colorado being confined to the two great valleys, and possibly that of the Cimarron. The presence of the Tertiaries in the valleys, telling their tale of erosion, was entirely overlooked.

"The Tertiary deposits overlap all the Cretaceous formations—Niobrara, Benton, Dacotah. In McPherson county, and south of the Arkansas, they are seen on the Triassic. In Marion and Sedgwick counties, they rest on the upper beds of the Permian—in the latter case coming east of the sixth principal meridian. A more thorough study of the position of the Tertiary deposits will reveal some intensely interesting facts as to the age of the erosion of our great valleys."

After some interesting statements about the glacial phenomena of northeastern Kansas and the superficial deposits of later times, the lecturer stated that economic geology has had much development, and that Kansas has not only metals and building-stones, but that stones—agates and jasper—are being found, of great value for ornamental purposes; and concluded as follows:

"There is a certain relation between gypsum and saline deposits. Owing to possible subsequent changes and omissions, we cannot always infer the existence of one from the presence of the other; but there is evidence of a cumulative character which we think points towards the discovery of another salt horizon of more recent formation than that now so successfully worked." . . . "In conclusion, we may express the desire that this audience will use means to influence legislators to cause a survey to be made of this State, which will aid in developing our resources, and help to bring scientific problems to a correct solution."

GEOLOGY OF THE LEAVENWORTH PROSPECT WELL.

BY E. JAMESON, LEAVENWORTH, KAS.

Mr. President, Ladies and Gentlemen: For some years, one of your members, a respected citizen of Leavenworth, has been preaching to us that there were both gas and oil under this city. One by one we became converted to his views, until Mayor Neely in 1887 prepared a bill, and had it presented and passed by the Legislature, authorizing this city to vote ten thousand dollars in bonds, to be spent in prospecting for gas. The City Council let the contract to Mr. Reed, an expert from Pennsylvania, and on the 17th day of October, 1887, the drill commenced to make its way through the rocks with the intention of reaching a depth of 3,000 feet, which the contract called for.

The Leavenworth coal mine is down to a depth of 1,100 feet, so that we knew the strata to that depth. At 550 feet the regular flow of salt water was struck, which has been found in all the mines. At 1,150 a very strong flow of salt water was struck. These two streams were shut off with casing, and in the next 600 feet five streams of water were struck, which flowed to within 100 feet of the top of the wall. At 1,700 feet a strong flow of sulphur water was struck—so strong, indeed, that it destroyed 500 feet of the hemp cable. On April 7th, 1888, at 1,802 feet, a new stratum of rock was reached, and when the drill was lifted the rope was saturated with petroleum, and so reported by Mr. Reed to Mayor Neely and myself. Steps were at once taken to shut off the water. This was found impossible; neither casing, patent stoppers nor seed-bags would shut off the immense flow. After careful consideration it was thought best to go further down, and when a hard rock was struck, to shut off the water. For the next 300 feet the rock was porous. The sand taken out was examined by experts, and pronounced to be oil-bearing rock of the very best kind, They all agreed, however, that the well was a failure, on account of the immense quantity of water.

There is no doubt gas was found in small quantities, for when the well was agi-